I. THE WATERSHED AND STUDY AREA

A. General Characteristics

1. The Watershed. Located in portions of Lake, Mason, Newaygo and Oceana counties, the Pere Marquette River system drains an area of approximately 740 square miles. Roughly 53 percent of the watershed is in Lake County. The mainstream starts at the confluence of the Middle Branch and Little South Branch, known as the "Forks" and flows in a westerly direction for approximately 67 miles to its mouth at Pere Marquette Lake, just south of the City of Ludington.
2. The Study Area. The area of study included the entire mainstream from its mouth at Pere Marquette Lake, its four major tributaries, the Baldwin River, Little South Branch, Big South Branch and the Middle Branch, as well as the numerous smaller tributaries which make up the system.

B. Physiography and Soils

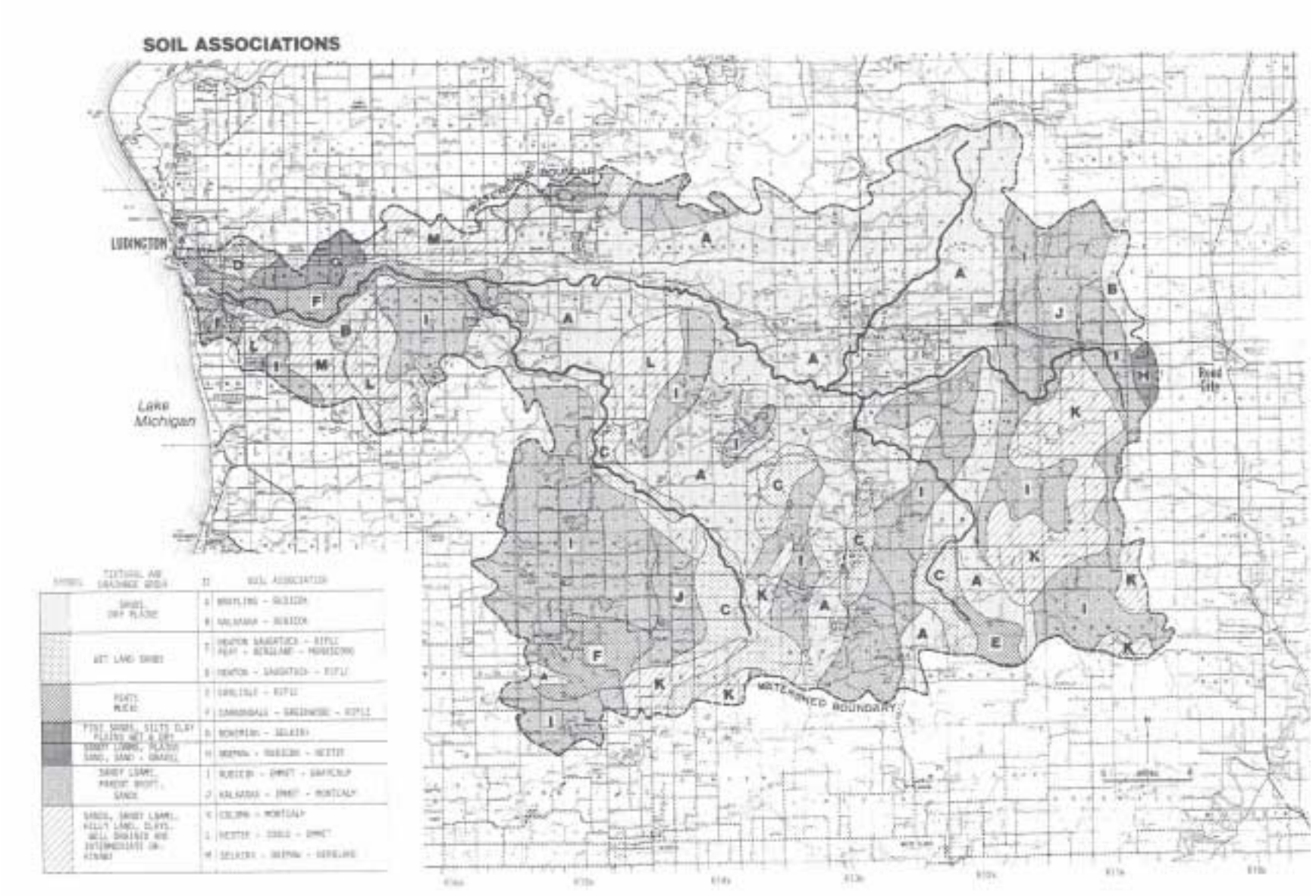
The topography of the watershed is rolling to flat. The eastern portion of the basin is characterized by its hilly nature, with the western portion generally being more broad and flat.

Like other watersheds in the area, the effects of glaciation are evident. Rolling, hilly moraines, flat outwash plains, kettle and oxbow lakes, eskers, drumlins, and kames can all be found in the watershed.

The majority of the watershed is dry sand plains and rolling sandy hills. These well-drained droughty soils make them generally unsuitable for agriculture, and hence, are in pine - scrub oak forests.

Poorly drained muck and peat soils are fairly common along the lower portion of the mainstream and the headwaters of the Big South Branch, some of which serve as agricultural drains.

Soils can be grouped into associations based on texture and drainage characteristics. These soil associations throughout the watershed along with their various characteristics can be seen on the map on the preceding page, along with the accompanying table.


SOIL ASSOCIATIONS
LUDINGTON
Lake Michigan
WATERSHED BOUNDARY

CHARACTERISTICS OF MAJOR SOIL ASSOCIATIONS

Soil Association	Natural Vegetation	Land Use If Cleared	USE LIMITATIONS						Percent of Watershed
			Septic Tank Disposal Fields	Cottages and Buildings	Intensive Use Camp Sites	Picnic Areas	Paths and Trails	Factors Limiting Use	
A	red, white, and jack pine; scrub oak	N/A	slight to moderate	slight to severe	moderate to severe	moderate to severe	moderate to severe	slope	35
B	red and white pine	N/A	slight to moderate	slight to severe	moderate to severe	moderate to severe	moderate to severe	slope	2
C	marshgrass, swamp hardwoods, northern hardwoods	N/A	severe	moderate to severe	moderate to severe	moderate to severe	moderate to severe	seasonal high water table	9
D	marshgrass, northern hardwoods, red and white pine	some grain crops	slight to severe	slight to severe	slight to severe	slight to severe	slight to severe	seasonal high water table	1
E	mixed hardwood	some hay and pasture	very severe	very severe	very severe	very severe	severe	seasonal high water table	1
F	mixed hardwoods, bog plants	N/A	very severe	very severe	very severe	very severe	severe	seasonal high water table	6
G	northern hardwoods	hay and small grain when drained	moderate to severe	slight to severe	slight to severe	slight to severe	slight to severe	slope and seasonal high water table	1
H	northern hardwoods, jack pine	some hay and grain	slight to severe	slight to severe	moderate to severe	slight to severe	slight to severe	slope	1
I	northern hardwoods, red and white pine	orchards and grain	moderate to severe	slight to severe	slight to severe	slight to severe	slight to severe	slope and seasonal high water table	10
J	northern hardwoods, red and white pine	some orchards and grain	slight to severe	slight to severe	slight to severe	slight to severe	slight to severe	slope and seasonal high water table	17
K	northern hardwoods	some orchards and grain	slight to severe	slight to severe	slight to severe	slight to severe	slight to severe	slope and seasonal high water table	2
L	white pine, hardwoods	orchards, hay and small grain	moderate to severe	moderate to severe	moderate severe	moderate to severe	moderate to severe	slope	7
M	northern hardwoods	hay, grain and truck crops	moderate to severe	slight to severe	slight to severe	slight to severe	slight to severe	slope and seasonal high water	4
N	northern hardwoods	hay and small grain drained	severe to very severe	severe	moderate to severe	moderate to severe	moderate to severe	seasonal high water table	4

C. Stream Characteristics

There are four main branches of the Pere Marquette River, as well as numerous tributaries. The following table summarizes the Pere Marquette system.

Mainstream	66.4 miles
Swainson Creek	8.0 miles
Lichte Creek	4.3 miles
Swan Creek	11.2 miles
India Creek	2.9 miles
Black Creek	2.5 miles
Weldon Creek	7.0 miles
Kinney Creek	3.3 miles
Tank Creek	2.3 miles
Danaher Creek	5.5 miles
Unnamed	12.1 miles
Big South Branch	41.5 miles
Carr Creek	9.1 miles
Ruby Creek	4.0 creek
Allen Creek	3.0 miles
Freeman Creek	14.8 miles
Triple Lake Creek	5.9 miles
Cedar Creek	13.7 miles
Beaver Creek (including drains)	38.6 miles
Winnepesaug Creek	19.1 miles
Unnamed	3.7 miles
Little South Branch	13.0 miles
McDuffee Creek	4.0 miles
Whipple Creek	.8 miles
Pease Creek	9.2 miles
Unnamed	2.0 miles
Middle Branch	17.0 miles
Blood Creek	2.8 miles
Baker Creek	1.9 miles
Unnamed	5.5 miles
Baldwin River	12.0 miles
Sanborn Creek	18.9 miles
Bray Creek	.7 miles
Leverentz Creek	.6 miles
Cole Creek (North & South Branches)	7.1 miles
Unnamed	8.2 miles

Total 379.7 miles

The water quality of the Pere Marquette system is protected for:

a. total body contact - recreation
b. agriculture
c. industrial water supply
d. navigation
e. public water supply
f. cold water fish

All of the mainstream, and with one or two exceptions, the tributaries, are being managed for cold water fisheries.

Water quality of the Pere Marquette system is excellent. The following table shows the chemical, physical and biological water analysis data for 1971 and 1977.

	Date:	1971 Mean*	1977 Mean**
Dissolved Oxygen	mg/1	11.85	9.06
Biochemical Oxygen	mg/1	1.37	.94

*1971 data based on four samples collected between February 16 and November 30, 1971.

**1977 data based on eight samples collected between January 19 and September 7, 1977.

Coliform			
Total		325	
Fecal	/100mg	12.5	63.8
Total Solids	mg/1	206.5	222.8
Suspended Solids	mg/1	5.25	9.1
Total Dissolved Solids	mg/1	201.3	213.6
Nitrate-Nitrogen	mg/1	0.10	0.10
Ammonia-Nitrogen	mg/1	.02	.01
Total Phosphate as P	mg/1	.03	.04
Soluble Phosphate as P	mg/1	.01	.01
Conductivity	unhos	315	328.8

Chloride	mg/1	.25	11.8
pH	log/H	8.1	8.1
Sulfate (dissolved)	mg/1	22.5	24.0*

*Based on one sample.

These values meet the parameters for cold water fish species. Due to the nature of the climate, surface geology and topography of the watershed, stream flow of the Pere Marquette system is relatively stable. April is the month of highest average discharge coinciding with the period of highest snowmelt. During the summer months, flow on the mainstream is adequate for recreational canoe use.

The Pere Marquette mainstream begins at the confluence of the Middle and Little South branches and empties into Pere Marquette Lake. The lower portion of the river from U.S. 31 bridge upstream for approximately 20 miles to Indian Bridge is characterized by low, wet swampy hardwood floodplain. Bottom type is predominately sand.

The river upstream from Indian Bridge to Walhalla Bridge is known as Nelan's Marsh. Here the river splits into many small channels, often difficult to follow. The marsh reaches a width of 1/2 to 3/4 mile and is bordered by high bluffs. Reeds, cattails and grasses occupy most of the area.

From Walhalla Bridge to Upper Branch Bridge, the river becomes more popular with canoeists and fishermen. This stretch of the mainstream is characterized by high steep banks with the river being from 30 to 60 feet wide. Stream bottom conditions are approximately half sand and half sand-gravel combinations.

From Upper Branch Bridge to Bowmans Bridge, a distance of about 15 miles, fishing and canoeing use increases. A long series of riffles known as Rainbow Rapids is located in this portion of the river. Bottom type is predominately sand-gravel.

Of all the tributaries, the Big South Branch drains the largest area, 259 square miles. Its source is an area of low swampy terrain and agricultural drainage system. These conditions cause water temperatures to be higher than on the other tributaries. Most of the stream bottom is sand, gravel and/or clay.

D. Vegetation

Vegetation along a river serves many functions, including stabilizing the soil and preventing erosion, absorbing nutrients, providing shade thus

cooling the water, and providing a visual barrier giving privacy to the property owner and maintaining the aesthetics along the river corridor.

The major vegetative types in the basin are aspen, jackpine, scrub oak, northern hardwoods, red and white pine plantations and mixed swampland species. Most of the forest stands are in second and third growth, with over 70 percent of the watershed forested.

E. Climate

The climate of the Pere Marquette watershed is continental in nature, common to much of northeast United States. The mean annual temperature for Baldwin is 45º F, and for Ludington the mean annual temperature is 47ºF. Precipitation is fairly well distributed throughout the year. In Baldwin, the mean annual precipitation is 32.7 inches and in Ludington, this amount is somewhat less, about 30 inches per year. The mean snowfall between the two communities is virtually the same. In Baldwin, the amount is 61.3 inches and in Ludington, the amount is 61.4 inches.

F. Ownership

There are approximately 740 square miles or about 473,000 acres in the Pere Marquette watershed. Of this total, approximately 25 percent is in public ownership.

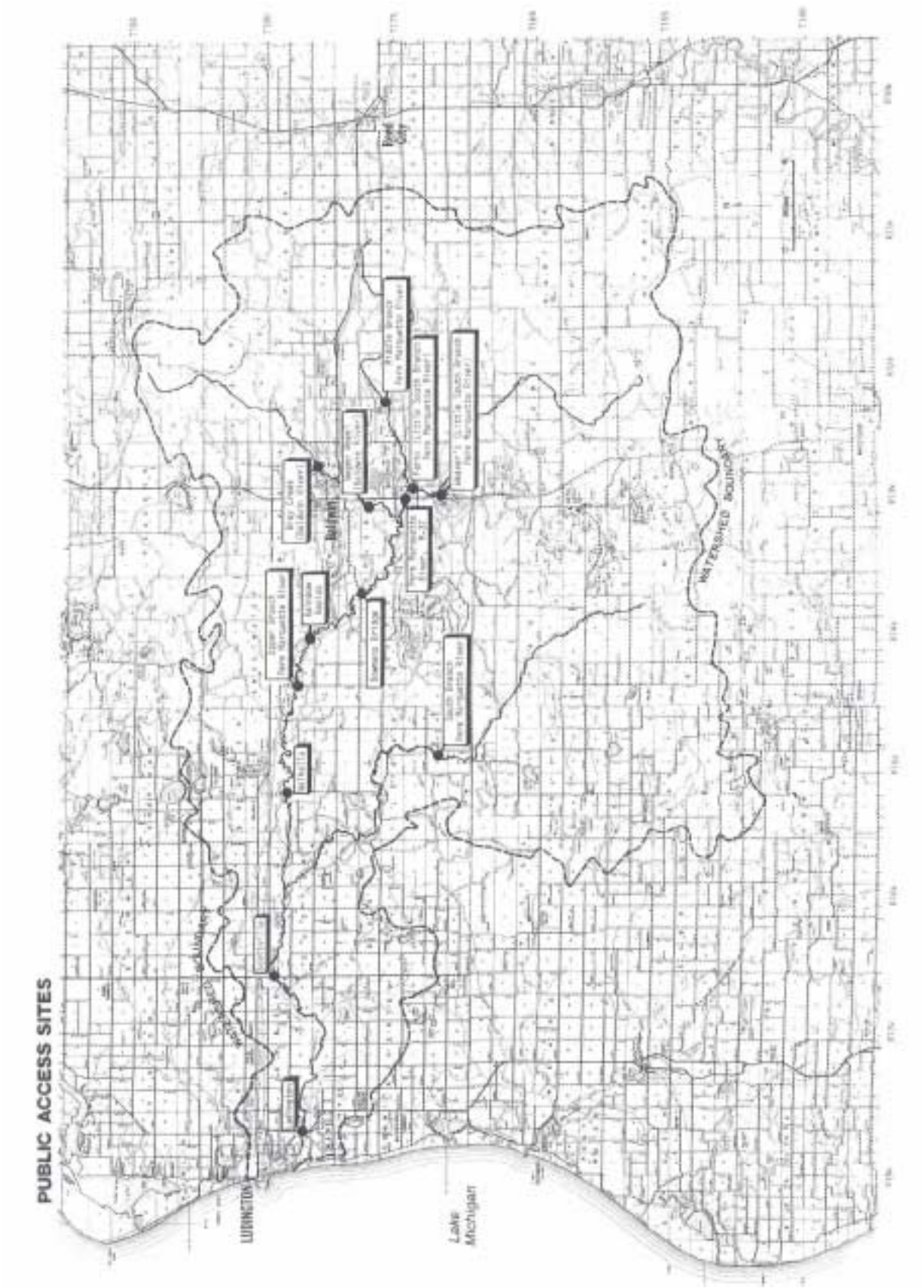
Ownership of river frontage on the mainstream and four major tributaries is summarized below:

	U.S. Forest Service		State of Michigan		Township		Private	
	Miles	%	Miles	%	Miles	%	Miles	%
Mainstream	11.2	8	21.6	17	2.4	2	97.6	73
Middle Branch	2.7	7	.9	2	0	0	30.4	91
Little South Branch	1.0	4	0	0	0	0	25.0	96
Baldwin River	0	0	3.5	14.5	0	0	20.5	85.5
Big South Branch	23.5	28	2.5	3	0	0	67.0	69

G. Accessibility

The major north-south highways through the watershed are U.S. 31 and M-37. The major east-west route is U.S. 10, which roughly parallels the entire mainstream. These highways link the large population centers of southern Michigan as well as those of neighboring states to the watershed, making access easy for millions of people.

The Chesapeake and Ohio Railroad provides scheduled auto ferry service across Lake Michigan to Ludington from Milwaukee and Manitowac, Wisconsin. In addition, there are two airfields in the watershed; one near Baldwin and the other near Ludington.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